Chapter 2

Supply and Demand

2.0 Preliminaries

The resource allocation problem ("What, How and For Whom") facing every economy can be solved in several different ways, (REM: PREVIEW 1.2). As we also said in that PREVIEW, most so-called capitalist or market economies are really "mixed" economies, that is, the resource allocation problem is solved through some combination of private and public decision making. Nevertheless, at the heart of the mixed economy is the market system – it has by far the dominant role in solving the resource allocation problem (as well as the coordination problem). To understand how a market system works one must understand what markets are and how they function. And to understand markets one must understand the workings of supply and demand. Supply-and-demand analysis is central to the study of market economies and the supply-and-demand model is the central model in economics.

2.1 Markets

DEF 2.1: A market consists of a group of (actual or potential) buyers and sellers of some product (a good or a service) who are able to engage in exchange.

Broadly speaking, the concept "market" means any arrangement that brings buyers and sellers together to trade, or to buy or sell a specific good or service.

NOTE 2.1: We frequently use the term market and industry interchangeably, especially if the focus is on the producer’s or seller’s side of the market.

Markets can have actual physical locations, such as farmers' markets in many American cities and in other parts of the world or the markets for stocks such as the New York Stock Exchange. Markets can be national or even global, such as the market for gold,
which includes gold mining companies, gold refiners, gold dealers and buyers of gold such as jewelry manufacturers who are scattered all over the globe. Markets can also be “virtual,” involving people and institutions tied together by modern communications networks such as the Internet.

In Chapter 7 we study several market structures in detail, but the workings of a market system can be introduced most easily by examining competitive markets. A detailed definition of so-called “competitive markets” will be given in that chapter, but for now the following definition will suffice:

DEF 2.2: A competitive market contains many buyers and sellers. The number of buyers and sellers must be so large and each of them so small in relation to the market as a whole, so that no individual buyer or seller is able to determine (or even influence) the market price.

This definition implies that sellers in competitive markets take the market price as given, that is, they simply accept the price determined by the market or, by what we label “market forces,” i.e., the forces of supply and demand. We therefore call these sellers price takers. (Sellers who are able to determine the prices at which they sell are called price setters.)

EXAMPLE 2.1: It is hard to give examples of markets which exactly satisfy the definition of competitive markets. (We say more on this topic in Chapter 7). But many branches of agriculture come close. Take corn – there are hundreds of thousands of farmers who raise corn, none of them large enough to be able to influence corn prices by varying their output.

Since markets consist of buyers and sellers, to understand the workings of individual markets (and ultimately the market system) we must study the behavior of buyers and sellers. We summarize the behavior of buyers in a market by the term demand and the behavior of sellers by the term supply. It turns out that the study of competitive markets and the study of supply and demand largely overlap.
2.2 Demand

As we noted above, we apply the term demand to the behavior of buyers in a market. Buyers may be consumers (households), industrial purchasers of raw materials, employers of labor, etc.

DEF 2.3: The demand for good X (i.e., some good) is defined as the relationship between the different possible prices of good X and the resulting quantities (called quantities demanded) that buyers are willing and able to buy under given circumstances.

DEF 2.4: The quantity demanded of good X is the amount of good X buyers are willing and able to buy at a particular price under given circumstances.

NOTE 2.2: In DEF 2.3 we define demand as the relationship between different possible prices and the resulting quantities demanded, etc. under given circumstances. The last phrase is an important part of the definition. By given circumstances we mean all the factors (economic and non-economic) which influence the demand for a good other than the price of that good. These “circumstances” are called the determinants of demand and we discuss them in detail in Section 2.7.

NOTE 2.3: DEF 2.3 says that demand is a relationship between different possible prices and the quantities buyers are willing and able to buy, etc. Simply wanting a good does not constitute demand from an economic point of view. Buyers must have the purchasing power to "back up" their desire for a good.

It is useful to think of demand as a schedule (or table). Consider Table 2.1. The first column is headed "Price (P)" and the second column "Quantity Demanded (Qd1)". Imagine that we conduct a hypothetical survey. We ask a potential buyer (Buyer No. 1),
Table 2.1 Individual Demand Schedule

<table>
<thead>
<tr>
<th>Price (P)</th>
<th>Quantity Demanded ($d_1$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$5</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

“If the price of product X is $5, how many units would you buy?” Buyer No. 1 responds that at that price he would not buy any amount. So we place a “0” in the $d_1$ column. We then ask, “if instead the price were $4, how many units would you buy?” He now responds, “one unit,” and so we place a “1” in the $d_1$ column. Proceeding this way we complete the rest of the table. We call Table 2.1 an individual demand schedule.

Table 2.2 Market Demand Schedule

<table>
<thead>
<tr>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>$d_1$</td>
<td>$d_2$</td>
<td>$d_3$</td>
<td>$d$</td>
</tr>
<tr>
<td>$5</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>4</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>5</td>
<td>9</td>
<td>18</td>
</tr>
</tbody>
</table>

But to understand the workings of a competitive market we must study market demand. Table 2.2 includes three individual demand schedules (Columns 1 and 2 through 4), including that of our first buyer. (The subscripts 1, 2, 3, refer to the three individuals.). Column 5 (marked $d$) is obtained by adding up the quantities demanded by each of the three potential buyers at every possible price in the available set of prices. Column 1 and column 5 together constitute the market demand schedule for product X.

NOTE 2.4: In Table 2.2, as the price falls from $5 to $4 to $3, etc., the quantity demanded increases from 2 to 6 to 10, etc. That is, as the price falls, quantity demanded increases and vice versa. These numbers embody an important economic relationship called the law of demand. This “law” will be discussed in Section 2.6. For now just note that in choosing our numbers we are assuming that there is an inverse relationship between price and quantity demanded.

NOTE 2.5: In our definition of a competitive market we said that such a market must contain many buyers and sellers. The term many is hard to
define; However it clearly means more than three! But there is not enough space on a page or a computer screen to show really many individual demand schedules so the three that we do show should be thought of as representing "many," say 300, 3,000 or any “large” number we wish to consider.

### 2.3 Demand versus Quantity Demanded

We present two definitions in Section 2.2: **DEF 2.3** defines *demand* and **DEF 2.4** defines *quantity demanded*. It is very important to differentiate between these two concepts, and we will point this out several more times in this chapter. **DEF 2.3** implies that by the term *demand* we mean the whole set of price-quantity pairs that make up a demand schedule, or, in other words, the entire relationship between different possible prices and the resulting quantities buyers are willing and able to buy under given circumstances. If instead, the focus is on some specific quantity that buyers are willing and able to buy at a particular price, we refer to this as the *quantity demanded* at that price. For example, consider Table 2.2 again; we could ask, how many units of good X are buyers willing and able to buy at $P = 4$? Column 5 tells us that the answer is 6 units. We call this the *quantity demanded* at $P = 4$. Mixing up these terms leads to a great deal of confusion as will be shown later in this chapter. It turns out to be equally important to differentiate between a *change* in demand and a *change* in quantity demanded. (See **Section 2.5**.)

**EXAMPLE 2.2:** A reporter writes in the *Wall Street Record* that since gasoline prices have risen by more than $1 a gallon in recent months, the *demand* for gasoline has dropped by almost 5 percent. This terminology is acceptable in everyday language and even in business language but should be avoided in settings requiring precision in language such as economics classes! To be strictly accurate the reporter should write: “gasoline prices have risen; hence the *quantity demanded* of gasoline has fallen.”

### 2.4 Demand Curves

Economic relationships can be shown most vividly in graphic form (REM: Chapter 1, Appendix). We take the information from Table 2.2 and plot it in a graph. In FIG 2.1 on the next page quantities (measured in physical units) are shown on the horizontal axis and prices (measured in dollars per unit) are shown on the vertical axis. The resulting plot of points, called a *scatterplot*, gives a visual representation of the relationship between price and quantity demanded contained in the market demand schedule. We
then join the set of points with a smooth curve or line (FIG 2.2, on the following page). The resulting curve, labeled "DD" is called a demand curve (even if it is a straight line!)

NOTE 2.6: The demand curve DD has a negative slope (REM: Chapter 1, Appendix), that is, it slopes down from Northwest to Southeast or from left to right. This is simply a graphic representation of the same fact we noted in the discussion of demand schedules: price and quantity demanded move in opposite directions, a relationship we call the law of demand. (See Section 2.6.)

NOTE 2.7: In Section 2.3 we pointed out the important distinction between the concepts demand and quantity demanded as applied to demand schedules. The same distinction applies of course to demand curves. When we use the term demand, we mean the entire relationship between different possible prices and the resulting quantities demanded shown by the whole demand curve DD. Such a curve represents the market demand for a good under given circumstances. If instead we focus on a specific quantity buyers are willing and able to buy at a particular price, we call this the quantity demanded at that price and it is represented by a single point lying on a demand curve.

EXAMPLE 2.3: Look at demand curve DD in FIG 2.2. When P = $3 we say the quantity demanded (not the demand) is 10 units. This is shown by point E on the demand curve. Alternatively, if P = $4 the quantity demanded is 6 units, shown by point B.

FIG 2.1   Demand (Scatterplot)
NOTE 2.8: Another way to think about the phrase “under given circumstances,” (i.e., the *determinants of demand*; see NOTE 2.2) is the following: We can say that demand curve $DD$ in FIG 2.2 is “true,” that is, it describes the demand for a good or service under the circumstances that prevail *at a moment in time* or on a particular date. So demand curve $DD$ may tell us what the demand for good X is on June 10, 200X but a week later or a year later (or in rapidly moving markets, like the financial markets a minute later!) circumstances may have changed and the demand curve will be located somewhere else (to the left or the right of $DD$). But the new demand curve will still have a *negative slope*; the law of demand has not been repealed!

![FIG 2.2 Demand Curve](image)

2.5 *Change in Demand versus Change in Quantity Demanded*

In *Section 2.3* and Note 2.7 we emphasized that it is important to differentiate between the concepts *demand* and *quantity demanded*. A similar distinction must be made between a *change in demand* and a *change in the quantity demanded*. Briefly, a *change in demand* is caused by a change in one or more of the determinants of demand (*Section 2.7.*) while a change in the *quantity demanded* is caused *only* by a change in price. A change in demand is shown graphically as a shift of an *entire* demand curve while a change in quantity demanded is shown graphically as a movement from one point to another point on the *same* demand curve.
**Change in Demand**

Look at FIG 2.3 below. The demand curve labeled $DD$ is identical to the one shown in FIG 2.2. It should be clear from the discussion in **Section 2.4** and in **NOTE 2.7** that demand curves are constructed on the assumption that “circumstances” stay the same, that is, the determinants of demand remain unchanged. But we know that in real life circumstances do change! Assume then that one or more of the determinants of demand change in such a way that buyers are willing and able to buy more of a good at *every possible price*. Consider point $A$ on demand curve $DD$. It says that under the *old* circumstances, at a price of $5 buyers in this market were willing and able to buy 2 units. But circumstances have changed and at a price of $5 they are now willing and able to buy 6 units. It is as though point $A$ migrated to point $A'$. Similarly, consider point $B$. It says that under the *old* circumstances at a price of $4 buyers were willing and able to buy 6 units, but under the new circumstances they are willing and able to buy 10 units. So it’s as though point $B$ migrated to point $B'$. The same thing can be said about any point on the “old” demand curve: all its points “migrate” to the “new” demand curve.

**FIG 2.3  Change in Demand**

![Graph showing change in demand](image)

So we say that there has been an *increase in demand* and show this graphically as a shift to the *right* (or up) of the *entire* demand curve, to a new position shown by $D'D'$. (The shift is shown in FIG 2.3 by the broken arrows.) Similarly, if circumstances change in such a way that buyers are willing and able to buy *less* of the good at *every possible price* we say that there has been a *decrease* in demand and show it graphically as a shift to the
left of the entire demand curve, say from \( D'D' \) to \( DD \). An increase or a decrease in demand as described above we call a change in demand.

**QUESTION 2.1:** Assume the demand for good X today is shown by \( DD \) in FIG 2.3. A year from now there is a change in “tastes and preferences.” (NOTE: In Section 2.7 we call tastes and preferences one of the “determinants of demand.”) The change is favorable, that is, for some reason consumers “like” good X more than before. What will happen?

**ANSWER 2.1:** There will be an increase in demand and this will be shown graphically as a shift to the right of the entire demand curve, say to \( D'D' \).

**Change in Quantity Demanded**

Consider demand curve \( DD \) in FIG 2.3 again. If we assume that circumstances do not change, that is, the determinants of demand remain constant, then the demand curve “stays put,” i.e., there is no shift of the \( DD \) curve. Then if for some reason there is a change in price, there will be a movement up or down the demand curve and we say there is a change in the quantity demanded. So a change in demand is shown as a shift of the entire demand curve, while a change in the quantity demanded is shown as movement from one point to another point on the same demand curve.

**QUESTION 2.2:** Assume the demand for good X is shown by \( DD \) in FIG 2.3. Further assume that the determinants of demand remain unchanged but the price of good X for some reason drops from $3 to $2. What will happen?

**ANSWER 2.2:** There will be an increase in the quantity demanded (not in demand!) from 10 units to 14 units, shown graphically as a movement from point \( E \) to point \( C \) along demand curve \( DD \).

### 2.6 The Law of Demand

**Law of Demand:** The law of demand states that (for most goods under most circumstances) price and quantity demanded are inversely related ceteris paribus (or other things remaining the same).

The law of demand asserts that for most goods and services most of the time, when the price drops, the quantity demanded increases and vice versa. The phrase ceteris paribus (REM: Chapter 1, NOTE 1.6) is an important part of the statement of the law. We can be
reasonably certain that if the price of good X increases the quantity demanded will decrease (and vice versa) only if “other things” which influence the demand for good X (namely the determinants of demand!) remain unchanged.

NOTE 2.9: One occasionally (maybe more than occasionally?) hears the following expression:

The law of demand states that when the price goes up the demand goes down and vice versa.

Wrong! It should be clear from the discussion in Section 2.3 and in Section 2.5 that this is incorrect. When you “speak economics” you should say: “When the price goes up the quantity demanded goes down and vice versa.”

NOTE 2.10: We use the phrases “for most goods” and “under most circumstances” in the definition of the law of demand since in general economic “laws” should be stated cautiously. There can always be exceptions, some of which we will encounter in later chapters.

Why Should You Believe in the Law of Demand?

1) Empirical Evidence

Numerous studies have been conducted by economists and statisticians over many decades to explore the demand for different goods and services. Almost invariably they show an inverse relationship between price and quantity demanded. (Some of these studies are discussed in Chapter 3.) Unfortunately, in real life "other things" which influence the demand for particular goods or services do not remain constant. Yet these factors must somehow be dealt with in statistical studies of demand. To do this one must use complex statistical techniques and the results are often ambiguous. But based on the accumulated evidence we are entitled to conclude that there exists a large amount of statistical confirmation of the law of demand.

EXAMPLE 2.4: FIG 2.4 on the next page depicts the long-run world demand for oil as estimated by the energy economists and others listed in the sources on page 12. (“Long-run” means in this case that consumers of oil have had sufficient time to adjust to price changes.) Note that the
estimated demand curve has a negative slope, so we conclude that the law of demand applies to the long-run demand for oil.

**NOTE 2.11:** A careful examination of FIG 2.4 indicates that at the time these estimates were made (the period from the late 1970s to the early 1990s) at a price of $20/barrel the quantity of oil demanded would have been approximately 22 billion barrels per year while at a price of $30/barrel the quantity demanded would have been approximately 17 billion barrels per year.

(2) **Business Behavior**

If economic laws such as the law of demand are valid, then business behavior, i.e., what business people actually do in their everyday activities must in one way or another conform to these laws. Can you think of an action that business people take practically every day which indicates that they believe in the law of demand? The most common answer to this question is *sales*. Retailers (but not only retailers!) know very well what to do if they have excess inventory on their shelves or in their warehouses: announce a sale (i.e., lower prices) and your excess inventory will usually disappear, that is, the “quantity demanded” will rise.

**FIG 2.4 Long-Run World Demand for Oil**

![Graph showing the long-run world demand for oil with a negative slope, indicating the law of demand applies.](image-url)

**QUESTION 2.3:** Does this mean that business people *consciously* base their actions on rules derived from economic laws such as the law of demand?

**ANSWER 2.3:** Not necessarily. It is enough for them to act *as if* they believe in the law of demand (even if they have never heard of it!) This is sufficient for us to claim that the law of demand is (at least to some extent) validated by their actions.

**Introspection**

Most people when asked to consider their own reactions will admit (perhaps after some hesitation) that they would buy more of some (many? most?) goods if the price is lowered and vice versa.

**Economic Theory**

Economists have been asking what lies behind the law of demand practically since the beginning of modern economics. The answer to this question has evolved over time and one type of answer which involves the concept *utility* will be discussed in Chapter 4. Here we provide a brief answer in terms of two concepts: the *substitution effect* and the *income effect*.

**Substitution Effect:** Economists believe that generally there exists *substitutability* among goods, i.e., goods are substitutable for one another, both in production and consumption. (You don’t *have* to have steak for dinner; you can have chicken.) Now imagine that the price of good X drops. The prices of all other goods stay the same and so does your dollar income (called your *nominal* income). Good X has now become relatively cheaper in relation to some substitute good Y and you will therefore substitute more of good X for some of this other good. We say that you *substitute toward* a relatively cheaper good and *substitute away* from a relatively more expensive good. This pattern, called the *substitution effect*, partly explains the negative relationship between price and quantity demanded.

**NOTE 2.12:** When we say that good Y is a substitute for good X, we don’t mean that it is an *inferior*
substitute. The term substitute is used neutrally: We say good Y is a substitute for good X and vice versa, without any implication of inferiority or superiority.

**Income Effect:** Imagine again that the price of good X drops while the prices of all other goods as well as your nominal income stay the same.

**QUESTION 2.4:** What happens to your real income? (By “real income” we mean the actual collection of goods and services you are able to buy, that is, your “purchasing power.”)

**ANSWER 2.4:** Your real income has gone up, that is, you are able to buy more with your nominal income: your purchasing power has increased.

Because your purchasing power has increased, you will buy more of many (most?) goods and services, probably including good X. This behavior pattern, called the *income effect*, also partly explains the law of demand: If the price of good X decreases, buyers will probably buy more of it and vice versa, hence again the demand curve will have a negative slope.

**NOTE 2.13:** We say that people will “probably” buy more of a good because this is not always true. In Section 2.7 we note that consumer goods are classified into “normal” and “inferior” goods. Consumers will buy smaller amounts of inferior goods as their real income rises and vice versa. Hence all we can say is that usually but not always the income effect and the substitution effect work in the same direction.

**NOTE 2.14:** Whether the income effect is significant or not for any particular good depends on the proportion of a spending unit’s budget which is devoted to that good. Think of a household some of whose members chew gum. Even a doubling of the price of chewing gum will have a trivial effect on their real income; hence the income effect (but not the substitution effect!) will be hardly noticeable. But if the item involved is (for example) housing the income effect can be considerable.
2.7 Determinants of Demand

Demand was defined in DEF 2.3 as the relation between different possible prices and the resulting quantities that buyers are willing and able to buy under given circumstances. In NOTE 2.2 we said that by the phrase given circumstances we mean the determinants of demand as defined below:

DEF 2.5: Determinants of demand are all factors which influence the demand for a good or service other than the price of that good or service.

NOTE 2.15: It is important to understand that the price of the good or service being considered is not included among the determinants of demand. To emphasize this point some writers call these factors the non-price determinants of demand.

What then are these determinants of demand? What factors influence the demand for some particular good or service? The simple answer is “everything.” It is not too hard to come up with a very long list of factors which to one degree or another will affect the demand for shoes, bicycles, vacations in the Caribbean or a million other goods and services. But “everything” is too much to handle so we would like to develop a list of relatively broad categories into which almost all such factors can be placed. We now discuss a standard list of such categories.

(1) Incomes and/or Wealth of Buyers

From an economic perspective a major factor determining the demand for a good (or service) is the incomes and/or wealth of actual or potential buyers of that good or service.

DEF 2.6: Wealth is defined as a stock of items of value owned by an individual, household, corporation or other entity. These items can be real or financial. Both real and financial wealth can be transformed into purchasing power. Wealth is a stock variable.

NOTE 2.16: A stock variable is measured at a point in time such as on January 1, 2012.
NOTE 2.17: A flow variable is measured over a period of time, such as a week, a month, etc.

Consider a household. Wealth and income are measures of the household’s purchasing power and generally the higher their purchasing power the more people are “willing and able” to buy most goods and services. Note that we say most goods and services since there are exceptions. We classify goods into two broad categories: normal goods and inferior goods.

EXAMPLE 2.5: Many Americans own shares of stock, either directly or through mutual funds, pension plans, etc. When there is a stock market “crash,” i.e., the values of stocks fall rapidly, households are (and feel) less wealthy. This is usually accompanied by a sharp drop in consumer spending, that is, the demand curves for many goods and services shift to the left, which is what happened in 2007–2009 and was both a cause and consequence of the Great Recession of this period.

DEF 2.7: Income is defined as a flow of payments, usually in return for productive activity (including the “productive activity” of property owned by the income recipient). Income is a flow variable.

DEF 2.8: Good X is a normal good if the demand for it moves in the same direction as buyers’ incomes and/or wealth; that is, if incomes and/or wealth increase the demand for good X increases and vice versa.

DEF 2.9: Good Y is an inferior good if the demand for it moves in the opposite direction as buyers’ incomes and/or wealth; that is, if incomes and/or wealth increase the demand for good Y decreases and vice versa.

EXAMPLE 2.6: No-brand packaged foods, instant noodles, potatoes in some parts of the world (but not in others), inter-city bus travel (as opposed to flying) are examples of inferior goods (or services). Thinking of examples of normal goods is left as an exercise for the reader.
(2) **Prices of Related Goods**

The demand for a good is determined in part by the prices of related goods. Goods can be related in all sorts of ways, but in the study of demand there are two important relationships: goods can be substitutes or complements.

**DEF 2.10:** Good X and good Y are substitutes (or substitutable goods) if they can be used in place of each other, that is, good X can replace good Y and vice versa in at least some uses.

**QUESTION 2.5:** How does a change in the price of a good affect the demand for its substitute?

**ANSWER 2.5:** An increase in the price of a good (Good X) will cause an increase in the demand for its substitute, Good Y (the demand curve of Good Y will shift to the right). In other words, buyers will switch to the now relatively cheaper substitute, Good Y.

**EXAMPLE 2.7:** For most consumers, beef and chicken are substitutes. Usually when beef prices rise the demand for chicken (and other protein-rich foods) increases.

**DEF 2.11:** Good X and good Y are complements (or complementary goods) if they are used jointly, that is, either because of choice or necessity they are used together.

**QUESTION 2.6:** How does a change in the price of a good affect the demand for its complement?

**ANSWER 2.6:** The answer to this question is left as an exercise for the reader.

(3) **Tastes and Preferences**

The demand for goods and services is influenced by a broad array of forces to which we give the name “tastes and preferences.” The demand for particular goods is affected by fashions, fads, social factors of various kinds, national and ethnic differences, the effects of advertising and many other things. With a little effort, almost anything that influences the demand for some specific good or service can be placed in this category. Do Americans smoke less than 40 years ago because of health fears? Call it a result of a
change in tastes and preferences. Do the French eat more snails than Americans do? Tastes and preferences. Etc.

(4) **Number of Buyers**

Since a market demand schedule is obtained by adding up all the individual demand schedules of the potential buyers of a good or service, if there are more demand schedules to add up, the demand will increase and vice versa. So if we are interested in the demand for milk in New Jersey, if the population of New Jersey increases then whatever else may happen, for this reason alone we would expect the demand for milk to increase.

(5) **Expectations**

Economists have become more and more aware in recent decades of the important role played by *expectations* in economic life. We mean all kinds of expectations but especially expectations about future prices. If people generally expect the price of some good to increase the demand for it will almost always increase *now* (and vice versa) (assuming it is a storable good.)

**QUESTION 2.7:** Does including price *expectations* on this list contradict our earlier statement that the price of a good or service is *not* viewed as one of the determinants of demand?

**ANSWER 2.7:** The answer is left as an exercise for the reader.

We summarize the determinants of Demand in Table 2.3:

<table>
<thead>
<tr>
<th>Determinant</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Income/Wealth of buyers</td>
</tr>
<tr>
<td>(2) Prices of related goods</td>
</tr>
<tr>
<td>(3) Tastes and preferences</td>
</tr>
<tr>
<td>(4) Number of buyers</td>
</tr>
<tr>
<td>(5) Buyers’ price expectations</td>
</tr>
</tbody>
</table>

**2.8 Supply**

As we noted on page 2, we apply the term *supply* to the behavior of *producers or sellers*, or in short, “suppliers” in a market. Suppliers may be retailers, wholesalers, manufacturers, suppliers of labor, i.e. workers, etc. We discuss the concept *supply* along lines very similar to our discussion of demand, using almost identical words.
DEF 2.12: The supply of good X is defined as the relationship between the different possible prices of good X and the resulting quantities (called quantities supplied) that suppliers are willing and able to supply under given circumstances.

DEF 2.13: The quantity supplied of good X is the amount of good X suppliers are willing and able to supply at a particular price under given circumstances.

NOTE 2.18: In DEF 2.12 we define supply as the relationship between different possible prices and the resulting quantities supplied, etc. under given circumstances. Just like in our discussion of demand, the last phrase is an important part of the definition. By given circumstances we again mean all factors (economic and non-economic) which influence the supply of a good or service other than the price of that good or service. As you would expect, these circumstances are called the determinants of supply and we discuss them in detail in Section 2.13.

It is again useful to think of supply as a schedule (or table). Consider Table 2.4 below. The first column is headed "Price (P)" and the second column "quantity supplied (Qs1)". Imagine again that we conduct a hypothetical survey. We now ask a potential seller (Seller No. 1), "If the price of the product is $5, how many units would you produce and/or sell?" Seller No. 1 responds that at that price she would be willing to sell 4 units. So we place a "4" in the Qs1 column. We then ask, "if instead the price were $4, how many units would you sell?" She now responds, "3 units," and so we place a "3" in the Qs1 column. Proceeding this way we complete the rest of the table. We call Table 2.4 an individual supply schedule.

<table>
<thead>
<tr>
<th>Price (P)</th>
<th>Quantity Supplied (Qs1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$5</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 2.5  Market Supply Schedule

<table>
<thead>
<tr>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>Q_{s1}</td>
<td>Q_{s2}</td>
<td>Q_{s3}</td>
<td>Q_{s}</td>
</tr>
<tr>
<td>$5</td>
<td>4</td>
<td>5</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>4</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

But to understand the workings of a competitive market we must study market supply. Table 2.5 includes three individual supply schedules (Columns 2 through 4), including that of our first seller. (The subscripts 1, 2, 3, refer to the three sellers.). Column 5 (marked Q_{s}) is obtained by adding the quantities supplied by each of the three potential sellers at every possible price in the available set of prices. Column 1 and Column 5 together constitute the market supply schedule for product X.

**NOTE 2.19:** In Table 2.5, as the price drops from $5 to $4 to $3. etc., the quantity supplied in the market decreases from 18 to 14 to 10, etc. That is, as the price falls, quantity supplied falls and vice versa. These numbers embody another important economic relationship called the law of supply. This “law” will be discussed in Section 2.12. For now just note that in choosing our numbers we are simply assuming that there is a direct or positive relationship between price and quantity supplied.

**NOTE 2.20:** In our definition of a competitive market we said that such a market must contain many buyers and sellers. This is especially important when we are dealing with supply. Analyzing a market with only a “few” sellers raises all sorts of difficulties. We postpone the discussion of such markets for as long as possible. For now remember that the three supply schedules shown in Table 2.5 are meant to represent “many,” again say 300 or 3,000 or whatever “large” number you wish to consider.

### 2.9 Supply versus Quantity Supplied

The discussion in this and subsequent sections is very similar to our discussion of demand versus quantity demanded in Section 2.3. In Section 2.8 we present two definitions: DEF 2.12 defines supply and DEF 2.13 defines quantity supplied. It is again very important to differentiate between the two concepts. DEF 2.12 implies that by the term supply we mean the whole set of price/quantity pairs that make up a supply
schedule, or in other words, the entire relationship between different possible prices and the resulting quantities suppliers are willing and able to supply under given circumstances. If instead, the focus is on some specific quantity that suppliers are willing and able to supply at some particular price, this is referred to as the quantity supplied at that price. For example, looking at Table 2.5 we could ask, how many units of good X are sellers willing and able to sell at \( P = \$4 \)? Column 5 tells us that the answer is 14 units. We call this the quantity supplied at \( P = \$4 \). It will also turns out to be important to differentiate between a change in supply and a change in quantity supplied. (See Section 2.11.)

**EXAMPLE 2.8:** A news reader on Channel 5 Business News intones that because of a winter storm which paralyzed transportation systems on the East coast, the supply of heating oil in the metro area has fallen to 600 million gallons. He (or his writer) think of supply in physical terms: as a stock of so many millions of gallons available in oil tanks in a certain area on a certain date. In some circumstances this may turn out to be a useful way of thinking, but generally one should think of supply as a flow of some good (or service) whose magnitude depends on the price of the good (among other things).

### 2.10 Supply Curves

We now take the information from Table 2.5 and plot it in a graph. In FIG 2.5 below, quantities (measured in physical units) are shown along the horizontal axis and prices (measured in dollars per unit) are shown along the vertical axis. The resulting plot of points, gives a visual representation of the relationship between price and quantity supplied contained in the market supply schedule. We then join the set of points with a smooth curve or line (FIG 2.6). The resulting line is called a supply curve, labeled "SS" (even if it is a straight line!)

**NOTE 2.21:** The supply curve SS has a positive slope, that is, it slopes up from Southwest to Northeast or from left to right. This is simply a graphic representation of the same fact we noted earlier in the discussion of supply schedules: price and quantity supplied move in the same direction, a relationship we called the law of supply. (See Section 2.12)
NOTE 2.22: In Section 2.9 we pointed out the important distinction between the concepts *supply* and *quantity supplied* as applied to supply schedules. The same distinction of course applies to supply *curves*. When we use the term *supply*, we mean the *entire* relationship between different
possible prices and the resulting quantities supplied shown by the whole supply curve SS. Such a curve represents the market supply of a good under a given set of circumstances. But if instead we focus on a specific quantity that sellers in a market are willing and able to sell at a particular price, we call this the quantity supplied at that price and it is represented by a single point on a supply curve.

**NOTE 2.23:** Another way to think about the phrase “under given circumstances,” (i.e., what we call the determinants of supply) is as follows: We can say that supply curve SS is “true,” that is, it describes the supply of a good under the circumstances that prevail at a moment in time or on a particular date. So supply curve SS may tell us what the supply is on June 10, 200X but a week later or a year later (or in rapidly moving markets, like the financial markets a minute later!) circumstances may have changed and the supply curve will be located somewhere else (to the left or the right of the SS curve). But the new supply curve will still have a positive slope; the law of supply has not been repealed!

### 2.11 Change in Supply versus Change in Quantity Supplied

REM: In Section 2.9 we emphasized that it is important to differentiate between the concepts supply and quantity supplied. A similar distinction must be made between a change in supply and a change in the quantity supplied. Briefly, a change in supply is caused by a change in one or more of the determinants of supply while a change in the quantity supplied is brought about only by a change in price. A change in supply is shown graphically as a shift of an entire supply curve while a change in quantity supplied is shown graphically as a movement from one point to another point on the same supply curve.

**Change in Supply**

Look at FIG 2.7 on the next page. The supply curve labeled SS is identical to the one shown in FIG 2.6. It should be clear from the discussion in Section 2.10 and especially in **NOTE 2.22** that supply curves are drawn on the assumption that “circumstances” stay the same, that is, the determinants of supply remain unchanged. But we know that in real life circumstances do change! Assume then that one or more of the determinants of supply change in such a way that sellers are willing and able to sell more of the good at every possible price. Consider point E on supply curve SS. It says that under the old circumstances at a price of $3 sellers in this market were willing and able to sell 10 units.
But circumstances have changed and at a price of $3 they are now willing and able to sell 14 units. It is as though point E migrated to point E’. Similarly consider point H. It says that under the old circumstances at a price of $2 sellers were willing and able to sell 6 units, but under the new circumstances they are willing and able to sell 10 units. So it’s as though point H migrated to point H’.

The same thing can be said about any point on the “old” supply curve. So we say that there has been an increase in supply and show this graphically as a shift to the right (or down) of the entire supply curve, say from S’S’ to SS. An increase or a decrease in supply we then call a change in supply.

There is another, perhaps more informative way to explain why a change in supply is shown graphically as a shift of the entire supply curve. Consider point E in FIG 2.7 again. It says that under existing circumstances at a price of $3 the quantity supplied is 10 units. Now assume that there is a change in technology which makes it cheaper to produce good X. Producers are now willing to supply 10 units at a lower price than before, say at P = $2. It’s as though point E migrated to point H’. Similarly consider point J. Under the “old” circumstances (before the change in technology) producers were willing and able to supply 14 units at a price of $4. But circumstances have changed and they are now willing to supply 14 units at a price of $3. It’s as though point J migrated to point J’. The same thing can be said about any point on the “old” supply curve. We say that there has been an increase in supply and show it graphically as a shift down of the entire supply curve. A careful look at FIG 2.7 will convince you that a shift to the
right of a supply curve is equivalent to a shift down (and a shift to the left is equivalent to a shift up).

**QUESTION 2.8:** Assume the supply of good X today is shown by S’S’ in FIG 2.7. A year from now there is an increase in the price of a major input used in the production of good X. (NOTE: In Section 2.13 we call input prices one of the “determinants of supply.”) What will happen?

**ANSWER 2.8:** There will be a decrease in supply and this will be shown graphically as a shift to the left (or up) of the entire supply curve, say to SS.

**Change in Quantity Supplied**

Consider supply curve SS in FIG 2.7 again. If we assume that circumstances do not change, i.e., the determinants of supply remain constant, then the supply curve “stays put,” i.e., there is no shift of the SS curve either to the left or to the right. Then if for some reason there is a change in price, there will be a movement up or down the supply curve and we say there is a change in the quantity supplied. So a change in supply is shown as a shift of the entire supply curve, while a change in the quantity supplied is shown as a movement from one point to another point on the same supply curve.

**QUESTION 2.9:** Assume the supply for good X is shown by supply curve SS in FIG 2.7. Further assume that the determinants of supply remain unchanged but the price of good X for some reason drops from $3 to $2. What will happen?

**ANSWER 2.9:** There will be a decrease in the quantity supplied (not in supply!) from 10 units to 6 units, shown graphically as a movement from point E to point H along the supply curve.

### 2.12 The Law of Supply

**Law of Supply:** The law of supply states that (for most goods) price and quantity supplied are directly (or positively) related ceteris paribus (or other things remaining the same).

The law of supply asserts, in other words, that for most goods and services when the price increases, the quantity supplied increases and vice versa. The phrase ceteris paribus (REM: Chapter 1, NOTE 1.6) is an important part of the statement of the law.
We can be reasonably certain that if the price of good X increases the quantity supplied will increase (and vice versa) only if “other things” which influence the supply of good X (namely the determinants of supply!) remain the same.

**NOTE 2.24:** One occasionally (maybe more than occasionally?) hears the following expression:

![](image)

The law of supply says that when the price goes up supply goes up and vice versa.

**Wrong!** It should be clear from the discussion in Section 2.9 and especially in Section 2.11 that this is incorrect. When you “speak economics” you should say: When the price goes up the *quantity supplied* goes up and vice versa.

**Why Should You Believe in the Law of Supply?**

It turns out that the supply curve (which of course embodies the law of supply) is a special kind of cost curve, which takes into account the rising *marginal cost* of production as the output of farms, workshops, factories, offices, etc., increases. This topic will be discussed in detail in Chapters 5 and 6. In this chapter we confine ourselves to the notion of *incentives*.

**DEF. 2.14:** An *incentive* is any factor, (financial or non-financial) that motivates a particular course of action, behavior or decision.

Consider an oil refinery. It has a plant with different kinds of equipment and skilled workers, as well as stocks of crude oil. These resources can be employed interchangeably to produce gasoline, diesel fuel, home heating oil, lubricants, etc. Assume the price of home heating oil has *increased* while the prices of the other products have not changed. The refinery’s owners now have an *incentive* to shift resources from some of the other activities into the production of home heating oil and we say the *quantity supplied* of home heating oil will increase. The same process but in the opposite direction will be at work if the price of home heating oil were to *decrease*. So we attribute the law of supply to the incentive structure of a profit-driven economy, or more generally to the human propensity to respond to incentives.


**2.13 Determinants of Supply**

Supply is defined in **DEF 2.12** as the relation between different possible *prices* and the resulting *quantities* that producers are willing and able to produce and sell under *given circumstances*. In **NOTE 2.18** we said that by the phrase *given circumstances* we mean all the economic and non-economic factors which influence the supply of a good other than the price of that good and we call these factors the *determinants of supply*.

**DEF 2.15:** The *determinants of supply* are defined as all factors which influence the supply of a good other than the price of that good.

**NOTE 2.25:** It is important again to understand that the *price* of the good or service being considered is *not included* among the determinants of supply. To emphasize this point some writers call these factors the *non-price* determinants of supply.

From a broad perspective it turns out that supply is determined by *costs of production*. (Costs are discussed in Chapter 6.) Costs of production in turn are determined by *technology* and by the *prices of inputs*. These then are our first two determinants of supply.

**(1) The Prices of Inputs**

The cost of producing any good or service, hence its supply, clearly depends on the prices of the resources or inputs required in its production. Hence the wages of labor, the prices of raw materials and energy, the interest cost of capital are all determinants of supply.

**EXAMPLE 2.9:** Microprocessors are a major ingredient in the manufacture of personal computers of all kinds. As a result of technological developments in the manufacture of these microprocessors their prices have fallen sharply in recent years. Hence the supply of personal computers has risen (and their prices have fallen).

**(2) Technology**

From a longer run perspective costs of production are influenced by *technology*, by which we simply mean *methods of production* (which includes methods of organizing production). As methods of production improve it becomes less costly to produce many
goods and services, which affects their supply. Hence technology in a broad sense is one of the determinants of supply.

**EXAMPLE 2.10:** In the 1960s Dr. Norman Borlaug and his co-workers under the sponsorship of the Rockefeller Foundation developed improved strains of wheat, rice, maize and other cereals. This led to an increase in crop yields (hence supply!) in less-developed economies such as Mexico, India, Pakistan and Sri Lanka. This development came to be called the “Green Revolution.”

There are several additional determinants of supply.

(3) **Prices of Related Goods**

Just like in our discussion of the determinants of demand, prices of related goods are also determinants of supply. But the relationship between goods involved is different. Here goods X and Y are related if they require the same inputs in their production. Take the example of oil refineries again. (REM: Section 2.12, page 25) Assume that stocks of crude oil can be used to produce either home heating oil or gasoline.

**QUESTION 2.10:** If there is a cold winter and the price of home heating oil rises, what will happen to the supply of gasoline?

**ANSWER 2.10:** Refineries will divert crude oil and other inputs to the production of home heating oil (which is now more profitable), hence the supply of gasoline will drop (the supply curve will shift to the left or up).

(4) **Number of Producers or Sellers**

Since we obtain a market supply schedule (and hence a market supply curve) by adding up the individual supply schedules of all the producers or seller in a market, when more producers/sellers enter an industry supply will increase (and vice versa). So if we want to study the supply of milk in New Jersey, if more dairy farms spring up in the milk-producing areas of the Northeast of the United States the supply of milk in New Jersey will increase.

(5) **Expectations**

Just as in the case of demand, expectations, especially expectations about future prices, are a determinant of supply. But the link is more ambiguous than in our earlier discussion of demand. Consider two cases. In the first we are studying a good which can easily be stored. Then if its price is expected to increase, sellers may withhold it from the market and the supply, at least in the short-run, will decrease. In the second case we focus on a good that cannot be stored so easily and/or we view it from a longer run
perspective. Again the price is expected to increase. Then producers will acquire the necessary inputs, engage in production planning etc., and start production in anticipation of the higher prices. As a result the supply will increase. So in general, all we can say is that (price) expectations influence supply but we cannot specify in all cases the direction of influence.

We summarize the determinants of supply in Table 2.6:

<table>
<thead>
<tr>
<th></th>
<th>Determinants of Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Prices of Inputs</td>
</tr>
<tr>
<td>2</td>
<td>Technology</td>
</tr>
<tr>
<td>3</td>
<td>Prices of related goods</td>
</tr>
<tr>
<td>4</td>
<td>Number of producers/sellers</td>
</tr>
<tr>
<td>5</td>
<td>Sellers' price expectations</td>
</tr>
</tbody>
</table>

2.14 Supply and Demand

Studying demand is interesting and studying supply is also interesting (at least for economists!) but ultimately we do so in order to understand the interaction between demand and supply. We are interested in this interaction because we want to know how markets and the market system function. The following analogy may be helpful: Say a football game between the Miami Dolphins and the Washington Redskins is about to be broadcast on television. A group of commentators sit around a table in a TV studio or in the press box at the home stadium of the Redskins (called “FedExField”) discussing what they expect will happen in the game. First they discuss the Dolphins: their recent won-lost record, the injuries suffered by some of their players and so on. They do this without paying any attention to the other team, the Redskins. Next, they discuss the Redskins in the same manner: won-lost record, injuries, etc., while ignoring the Dolphins. Then the game starts and we can watch the two teams interacting on the field. In the same way, in this chapter we first discuss demand, i.e., the behavior of buyers, as though supply did not matter. Then we discuss supply, i.e., the behavior of sellers, as though demand did not matter. Now we “let the game begin”: we launch our analysis of supply and demand, or, in other words, the interaction between buyers and sellers on their playing field, the market.

The traditional way to proceed is to superimpose a supply curve and a demand curve on the same set of axes, which we do in Fig 2.8. This is probably the most famous diagram in all of economics. It even has a name: it is called the Marshallian cross, named after the famous English economist Alfred Marshall who was one of the first to draw a supply-
and-demand diagram. We shall use the term supply-and-demand diagram and supply-and-demand model interchangeably.

In this diagram, demand curve $DD$ is identical to the demand curve in FIG 2.2 and supply curve $SS$ is identical to the supply curve in FIG 2.6.

What does FIG 2.8 tell us? It says that given everything that we know about the determinants of demand, $DD$ represents the current demand for good X and given everything that we know about the determinants of supply, $SS$ represents the current supply of good X. Note that the demand curve and the supply curve intersect at point $E$. This point has a name: it is called the equilibrium point. The price corresponding to this intersection point is called the equilibrium price ($P_e$) and the quantity demanded and supplied ($Q_e$) at that price is called the equilibrium quantity. In FIG 2.8, $P_e = $3 and $Q_e = 10$.

The equilibrium concept is very important in economics and is defined below:

**DEF 2.16:** A market is in (short-run) equilibrium if there are no incentives for either buyers or sellers (suppliers or demanders) to change their behavior.

**NOTE 2.26:** There are in fact a number of equilibrium concepts in both microeconomics and macroeconomics, several of which we shall discuss in subsequent chapters. By “equilibrium” in this chapter we mean (short run) market equilibrium.

**NOTE 2.27:** In DEF 2.16, the phrase “change their behavior,” simply means “change the quantities buyers wish to buy and sellers wish to sell at the prevailing market price.”

Notice that in FIG 2.8 when the supply curve and the demand curve intersect, the quantity demanded (i.e., the amount buyers wish to buy) is equal to the quantity supplied (i.e., the amount sellers wish to sell). In symbols, $Q_e = Q_d = 10$. This is in fact a requirement for equilibrium and constitutes an alternative way of defining the equilibrium concept.

**DEF 2.17:** A market is in (short-run) equilibrium when $Q_d = Q_s$.  

29
DEF 2.17 is sometimes called the *equilibrium condition*, i.e., when \( Q_d = Q_s \) in any market we know that the market is in (short-run) equilibrium.

**NOTE 2.28:** The term “equilibrium” is borrowed from physics and means “at rest.” If a market is in equilibrium (or “at rest”) there is no tendency for the prevailing price and quantity demanded and supplied to change. Of course the equilibrium may be “disturbed” if there is a change in one or more of the determinants of supply and/or demand. We discuss such “disturbances” in a Section 2.15.

There is no guarantee that a particular market will be in equilibrium at any particular moment, or if it is in equilibrium that it will stay in equilibrium. If a market is not in equilibrium we say that it is in *disequilibrium*. We now make the following important statement about (competitive) markets:

**STATEMENT 2.1:** Generally, if a (competitive) market is in *disequilibrium*, forces will come into play which will tend to move it *towards* equilibrium.

**QUESTION 2.11:** What “forces” will come into play and by what process will they move the market towards equilibrium?
ANSWER 2.11: The “forces” mentioned in STATEMENT 2.1 are the forces of *competition* and the process by which markets are moved in the direction of equilibrium is called the “equilibrating process” and is discussed below.

*The “Equilibrating” Process*

Consider FIG 2.8 again. Assume that initially the market for good X is *not* in equilibrium. There are only two ways in which this can happen: either the actual market price is above the equilibrium price or it is below the equilibrium price. Assume that the actual price is above the equilibrium price, say \( P = $5 \). Then point A on the demand curve tells us that the quantity demanded at that price is 2 units and point \( K \) on the supply curve tells us that the quantity supplied is 18 units. The quantity supplied is larger than the quantity demanded. In symbols, \( Q_s > Q_d \). The amount sellers try to sell exceeds the amount buyers wish to buy. The result is a *surplus* (sometimes called “an excess supply”) of good X. This is shown by the distance from point A to point \( K \). (Note the horizontal bracket.)

**NOTE 2.29:** This is not an imaginary surplus. If for example good X is a physical good of some sort it may show up as excess inventory on store shelves or in warehouses!

**QUESTION 2.12:** What is the size of the resulting surplus?

**ANSWER 2.12:** The answer to this question is left as an exercise for the reader.

In competitive markets the existence of a surplus creates *downward pressure* on prices (shown by the arrow pointing down in FIG 2.8) as producers/sellers try to get rid of the surplus, i.e., to reduce their excess inventories. (This is what we mean by the “forces of competition.”) As prices drop the quantity demanded *increases*, shown by a movement *down* the demand curve (because of the law of demand) and the quantity supplied *decreases*, shown by a movement *down* the supply curve (because of the law of supply).

Say the market price drops to $4. Is the market now in equilibrium? Observe that when \( P = $4 \) the quantity demanded (indicated by point \( B \) on the demand curve) is 6 units and the quantity supplied (indicated by point \( J \) on the supply curve) is 14 units. It is still true that \( Q_s > Q_d \), so the market is *not* in equilibrium. Since there is still a surplus, there is further downward pressure on the market price. As the price drops, the quantity demanded increases and the quantity supplied decreases for the same reason as before, namely the laws of supply and demand.

Assume the market price drops to $3. Note that when \( P = $3 \), the quantities demanded and supplied are now equal, i.e., \( Q_d = Q_s = 10 \). This is shown by point \( E \). There is no
longer a surplus, therefore no further downward pressure on the market price; therefore no incentive for buyers or sellers to change their behavior. The market is now in equilibrium.

**NOTE 2.30:** One occasionally hears the following statement:

> When a market is in equilibrium both buyers and sellers are happy.

Actually the equilibrium concept says nothing about happiness or unhappiness. In fact, sellers may be happy about the equilibrium price and buyers may be unhappy or the other way around, etc. The various possible combinations of happiness and unhappiness are shown in the table below, which is left as an exercise for the reader to puzzle out.

<table>
<thead>
<tr>
<th></th>
<th>Happy</th>
<th>Unhappy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Happy</td>
<td>Buyers, Sellers</td>
<td>Buyers, Sellers</td>
</tr>
<tr>
<td>Unhappy</td>
<td>Buyers, Sellers</td>
<td>Buyers, Sellers</td>
</tr>
</tbody>
</table>

In the preceding discussion we began with the assumption that the prevailing market price was *above* the equilibrium price. We could just as easily have started instead with the assumption that the market price was *below* the equilibrium price.

**QUESTION 2.13:** By what process would a competitive market move towards equilibrium if initially the market price was *below* the equilibrium price?

**ANSWER 2.13:** The answer to this question is left as an exercise for the reader.

We have now completed construction of the skeleton of the supply-and-demand model. But it is only worthwhile to do this if we can put the model to some use. This we do in the next section.
2.15 Supply-and-Demand Analysis

The supply-and-demand model, like other models in economics should be viewed as a tool, like a calculator. It enables us to analyze certain economic (and even some non-economic) problems efficiently. We call this approach supply-and-demand analysis.

There are two basic types of supply-and-demand analysis. One type (call it type A) involves the following steps:

(1) Assume the market you are studying is in equilibrium.

(2) Some event occurs which disturbs this equilibrium, i.e., a there is a change in one or more of the determinants of supply and/or demand. Ask yourself: what shifts will occur in the demand curve, the supply curve or both?

(3) Find the new equilibrium point which results from these shifts.

(4) Inspect the supply-and-demand diagram and answer the question: what happens to the equilibrium price and the equilibrium quantity as a result of the “disturbing” event(s)?

**NOTE 2.31:** Generally, we give only qualitative answers to the question in (4). This means that unless we have a lot of statistical information about the demand and supply of the good or service we are studying and have access to sophisticated statistical software, all we are able to come up with is one of the following answers:

(1) The equilibrium price will rise and the equilibrium quantity will fall.

(2) The equilibrium price will fall and the equilibrium quantity will rise.

(3) The equilibrium price and the equilibrium quantity will both rise.

(4) The equilibrium price and the equilibrium quantity will both fall.

The second type of supply-and-demand analysis (call it type B) involves the following steps:

(1) Again assume the market you are studying is in equilibrium.

(2) Then for some reason there is some interference with the functioning of this market (often, but not always, due to the actions of some government or government agency) and the equilibrium price is not (or cannot be) attained.
NOTE 2.32: Supply and demand (and therefore supply curves and demand curves) will not be affected, since none of the determinants of demand and/or supply have been affected but only the price!

(3) Ask yourself the question: what will be the result of this situation? Two answers are possible: If the "imposed" price is below the equilibrium price there will be a shortage while if the imposed price is above the equilibrium price there will be a surplus.

When you are asked to do supply-and-demand analysis the first question you should ask is, which type? Type A or type B? We start with a discussion of type A.

**Supply-and-Demand Analysis: “Type A”**

We said in on page 30 (Section 2.14) that there is no guarantee that if a market is in equilibrium it will remain in equilibrium: the equilibrium may be “disturbed” as a result of changes in one or more of the determinants of supply and/or demand. Examining the consequences of such “disturbances” constitutes the type of supply-and-demand analysis we call type A.

Consider FIG 2.9 below: It reproduces the demand curve DD and the supply curve SS from FIG 2.8. Assume the market is initially in equilibrium and $P_e = $3, $Q_e = 10$. Then there is a change in one or more of the determinants of demand, say an increase in the wealth of the buyers of good X but no change in any of the determinants of supply. Hence the demand will increase (the demand curve shifts to the right, to $D'D'$) but the supply remains unaffected: the supply curve “stays put.” The result can be read off the diagram easily: The new equilibrium point $E'$ occurs at the intersection between the new demand curve and the old supply curve. The new equilibrium price is $3.50 (higher) and the new equilibrium quantity is 12 (higher).

This bit of analysis demonstrates the usefulness of models in general and the supply-and-demand model in particular. Once you have grasped the essentials of this model it is no longer necessary to go through a laborious analysis of the “equilibrating process.” It is understood that equilibrium occurs at the intersection between the supply curve and the demand curve. It is therefore also understood that the new equilibrium that results, say, from some change in one of the determinants of demand (when there is no change in any determinant of supply) will occur at the intersection between the new demand curve and the old supply curve.

But to deepen your understanding of the supply-and-demand model it is worthwhile to go through the equilibrating process one more time.
Assume again that the market illustrated in FIG 2.9 is in equilibrium at point E. Then there is a change in one of the determinants of demand as before and the demand for good X increases (the demand curve shifts to the right, to D'D'). Next, assume that the new equilibrium point (E') is not reached instantaneously. (This is in fact quite realistic: in many markets it may take some time before a new equilibrium is established.) Then for a while at least the old equilibrium price of $3 remains the actual market price. But at P = $3 the quantity supplied remains 10 units while the quantity demanded is now 14 units (shown by point K on the new demand curve D'D'). Hence the quantity demanded (14) exceeds the quantity supplied (10) and there is a shortage of good X. In competitive markets the existence of a shortage results in upward pressure on the market price as buyers compete against each other to obtain the good. As the market price rises the quantity demanded decreases and the quantity supplied increases (because the laws of supply and demand) and this process continues until the new equilibrium is reached. In FIG 2.9 this occurs at point E' as we said before.

Supply-and demand analysis provides us with a tool to answer two important questions that so far have remained unanswered: Why is it important to differentiate between demand and quantity demanded and between supply and quantity supplied (as well as between changes in demand and quantity demanded, etc.)? We use a dialogue between a student and a professor to answer this question in the case of demand and leave it as an exercise for the reader to answer the question in the case of supply.
STUDENT: “Isn’t it true that when demand goes up the price will go up, but when the price goes up the demand will go down; then when the demand goes down the price will go down, therefore the demand will go up, and so on forever?”

PROFESSOR: No, you are confusing demand and quantity demanded. Look at FIG 2.10 below. Assume this (competitive) market is initially in equilibrium at point $E$ at the intersection between demand curve $DD$ and supply curve $SS$. The equilibrium price is $3 and the equilibrium quantity is 10. Then for some reason there is a change in one or more of the determinants of demand and the demand goes up (the demand curve shifts to the right.) The new demand curve is $D'D'$. Then either quickly or slowly or somewhere in between a new equilibrium is established at $E'$. The new equilibrium price is $4 and the new equilibrium quantity is 12. End of story. Mixing up demand and quantity demanded leads to the kind of confusion contained in the question.

FIG 2.10 Demand vs. Quantity Demanded

PROBLEM 2.1: As the economy of Vidalia slowly recovers from the most recent recession, average real incomes are expected to rise. What is likely to happen to air fares and the volume of air travel (i.e., equilibrium prices
and quantities of air travel)? Assume that air travel is a normal good. (NOTE: The airline industry measures its “output” in units called “revenue-passenger miles” (RPM).)

**FIG 2.11  Supply and Demand for Air Travel in Vidalia**

**SOLUTION 2.1:** We start by assuming that supply-and demand analysis is in fact applicable to the airline industry. Consider FIG 2.11 above. Suppose that initially the demand for air travel is given by $DD$ and the supply by $SS$. Then the equilibrium air fare is $3 per RPM and the equilibrium volume of air travel is 10 (million RPM). When Vidalia’s economy recovers from the recession, real incomes rise and since air travel is a normal good, the demand for air travel will also rise, say to $D'D'$. The new equilibrium point is $E'$. The new equilibrium price is $3.50 per RPM (higher) and the new equilibrium quantity is 12 million RPM (higher).

**NOTE 2.33:** If we were to look at the market for air travel from a longer run perspective some other things might happen. For example, the higher air fares (if they were perceived as more or less permanent) might attract new firms into the airline industry or cause existing airlines to expand their fleets (or the number of flights using the existing fleets). This would increase supply, which would have further consequences for the equilibrium price and quantity, etc. But at least initially we want to avoid such complications and therefore we do not delve into
all the possible ramifications resulting from the initial increase in demand.

PROBLEM 2.2: Assume fertilizer prices decline because of a drop in the prices of inputs used in fertilizer manufacture. What is likely to happen to the equilibrium prices and quantities of crops such as wheat?

SOLUTION 2.2: Consider FIG 2.2. Initially the demand for wheat is shown by $DD$ and the supply by $SS$. The equilibrium price is $3$ and the equilibrium quantity is $10$ (million bushels). Then there is a decrease in the price of fertilizer, an input in the production of wheat. (REM: The price of an input is one of the determinants of supply.) The cost of wheat growing will drop, hence the supply will increase, shown as a shift to the right or down of the supply curve, say to $S'S'$. The new equilibrium point is $E'$. The new equilibrium price is $2.50$ (lower) and the new equilibrium quantity is $12$ million bushels (higher).

FIG 2.12 Supply and Demand for Wheat

PROBLEM 2.3: Assume the government conducts a successful "war on drugs" through the effective use of tougher penalties for drug dealing. What will happen to the equilibrium prices and quantities of illegal drugs?

SOLUTION 2.3: Consider FIG 2.13 below. Imagine that there is some generalized illegal drug measured in kilos. (Use your imagination.) Initially the demand is
Figure 2.13  Supply and Demand for Illegal Drugs

![Diagram of supply and demand for illegal drugs with DD and SS curves and equilibrium point E.]

given by DD and the supply by SS, with the equilibrium point at E. The equilibrium price is $2,500 per kilo and the equilibrium quantity is 12 (thousand) kilos.

When the war on drugs starts (or is intensified) penalties for drug dealing are toughened and it becomes more costly to deal in drugs. Hence the supply will decrease (the supply curve will shift up or to the left). The new equilibrium point is at E'. The new equilibrium price is $3,000 per kilo (higher) and the new equilibrium quantity is 10 (thousand) kilos (lower).

**PROBLEM 2.4:** Assume that the determinants of supply and demand for good X change in such a way that the demand increases but the supply decreases. What will happen to the equilibrium price and quantity?

**SOLUTION 2.4:** If there is an increase in demand and a decrease in supply the equilibrium price will definitely increase. The direction of change in the equilibrium quantity depends on the relative changes in demand and supply. There are three possibilities, two of which are left as an exercise for the reader.

In FIG 2.14 below, assume that initially the demand is given by DD and the supply by SS. The equilibrium point is E. Then the equilibrium price
is $3 and the equilibrium quantity is 10. The increase in demand is shown as a shift to the right of the demand curve, say to $D'D'$. The decrease in supply is shown as a shift to the left of the supply curve, say to $S'S'$. The new equilibrium point is $E'$. The new equilibrium price is $4 (higher) while the equilibrium quantity remains unchanged at 10.

**FIG 2.14  Changes in Supply and Demand**

![Graph showing changes in supply and demand](image)

**Supply-and-Demand Analysis: “Type B”**

We said on page 33 that there could be some sort of interference with the functioning of competitive markets with the result that the equilibrium price is not attained. Examining the consequences of such situations comprises the type of supply-and-demand analysis we call type B.

FIG 2.15 on the next page represents the supply and demand for wheat again. The horizontal axis shows quantities in millions of bushels and the vertical axis shows prices in dollars per bushel. The equilibrium price is $3/bushel and the equilibrium quantity is 10 (million bushels). Now assume that farmers are unhappy with the $3 price. They go to their representatives in Congress (or the Canadian parliament or the French parliament or whatever) and ask that something be done about it. Now, it is an interesting fact that farmers in many countries are politically influential (Why? This is a question of political economics which we try to answer in Chapter 24.) What can be done? Actually there are several possibilities. One is that Congress passes a law which
sets the price of wheat at $4 per bushel, i.e., above the $3 equilibrium price. Such a price is called a price floor.

**DEF 2.18:** The term *price floor* means that by law, regulation, custom, or for some other reason, a price may not fall below some level.

**FIG 2.15** Supply and Demand for Wheat and *Price Floor*

What is the result of establishing a price floor, assuming it is effective? Note that in FIG 2.15 at the $4 price the quantity demanded (shown by point B on the demand curve) is 6 million bushels while the quantity supplied (shown by point J on the supply curve) is 14 million bushels. The quantity supplied exceeds the quantity demanded, so on a first pass we conclude that price floors lead to *surpluses*.

**QUESTION 2.14:** Can the government proclaim that from now on the price of wheat is $4 per bushel and leave it at that?

**ANSWER 2.14:** No! We just noted that establishing an effective price floor leads to surpluses. As these surpluses accumulate farmers will be tempted to get rid of them. But selling the surpluses will drive the market price down again and the floor price will not be maintained. (Of course the
government could devote resources to enforcing the price floor by jailing violators, etc. But generally such policies are likely to be ineffective in democratic societies and maybe even in nondemocratic societies.)

**QUESTION 2.15:** Then what can the government do in addition to establishing a price floor?

**ANSWER 2.15:** There are several actions the government could take. The most common (and the simplest) is to buy up the surpluses and store them, or give them away to the poor, etc.

**NOTE 2.34:** We have used the phrase “*effective* price floor” several times. It simply means a price that does what it is intended to do. A price floor which *coincides* with the equilibrium price or falls *below* it is *ineffective*, i.e., it doesn’t do anything, since the equilibrium price would be attained *without* such a price floor. We conclude that an effective price floor must be *above* the equilibrium price.

**PROBLEM 2.5:** Consider FIG 2.16 below. It shows the market for rental housing in Bayville, in the state of Caltex. “Housing” is measured along the horizontal axis in some appropriate unit, whether it is rooms, apartments, square feet or whatever. The monthly rental (in dollars per unit per month) is shown on the vertical axis.

**NOTE 2.35:** In English like in other languages different prices often have different names. For example we talk about fees, tolls, wages, interest, etc.. The name given to the price of rental housing is “rental.” (Actually in ordinary language it is usually called “rent” but the word *rent* is used in economics in a very particular way so we will use the word *rental* instead.)

Now assume that people in Bayville are unhappy about the monthly rental they are paying and so they go to the city council and ask for relief. This relief takes the form of *rent controls*, i.e., in one way or another a *rent ceiling* is established. (The term rent ceiling is defined in DEF 2.19 below.) This means that a *maximum* rental is imposed and landlords are not allowed to charge rental prices above that level.

What will we read in the *Bayville Gazette* a few months (or perhaps a few years – it is hard to say) after rent controls are imposed?
We will read that a *housing shortage* has appeared in Bayville!

We start again by assuming that supply-and-demand analysis is in fact applicable to this market. Then the demand for housing in Bayville is given by $DD$, the supply by $SS$ and the equilibrium point is $E$. The equilibrium rental is $300$ per room per month and the equilibrium quantity is $10$ (thousand) units.

What is the result of establishing a price ceiling, assuming it is effective? Look at FIG 2.16. Let the rent ceiling be $200$. Then point $H$ on the supply curve indicates that the quantity of housing supplied is $6$ (thousand), while point $C$ on the demand curve indicates that the quantity of housing demanded is $14$ (thousand). So the quantity of housing demanded exceeds the quantity supplied. Hence a housing shortage.

**QUESTION 2.16:** What is the size of the housing shortage in Bayville?

**ANSWER 2.16:** The answer to this question is left as an exercise for the reader.

**QUESTION 2.17:** What do we mean by an *effective* price ceiling?
ANSWER 2.17: The answer to this question is left as an exercise for the reader.

PROBLEM 2.6: Use supply-and-demand analysis to explain why every weekday morning between 7:30 A.M. and 9:30 A.M and on weekday afternoons between 4:00 and 5:30 P.M. there are huge traffic jams at the George Washington Bridge (GWB) and other Hudson River crossings.

SOLUTION 2.6: The reader’s reaction to this problem might be: (a) what has this to do with economics? and (b) Isn’t the answer obvious? During these hours many people are driving to or from work; the river crossings have a limited capacity, so obviously there are going to be traffic jams!

The reader is urged to be patient! Our aim is to demonstrate the usefulness of microeconomics in general and supply-and-demand analysis in particular for understanding (and making policy recommendation about) many different kinds of economic as well as seemingly non-economic problems and issues.

Look at FIG 2.17. As usual along the horizontal axis we measure quantities, but quantities of what? What “service” does the Port Authority of New York and New Jersey (which owns and runs the GWB) perform and in what “units” should this service be measured? Let one “crossing” of the bridge by one vehicle constitute one unit and so the scale along the horizontal axis measures the number of crossings per hour. Along the vertical axis we measure the price per crossing which of course is called a “toll.”

FIG 2.17 Supply and Demand for “Crossings” at GWB and Fixed Toll
NOTE 2.36: Notice again the kind of simplifications we make when we construct a model. Actually the bridge is not crossed by “vehicles,” but by trucks, vans, buses, passenger cars, motorcycles, etc., all of them paying different tolls! If we wanted to analyze bridge traffic in detail for some reason we would have to differentiate among these different kinds of vehicles and the different tolls they pay but for our immediate purpose this is unnecessary and doing so would just create needless complexity.

Now we know that tolls on bridges, tunnels, toll roads, etc., remain unchanged for long periods of time but we are doing supply-and-demand analysis, so we have to ask “what-if” questions: What would be the number of crossings “demanded” at different possible levels of the toll?

Of course to actually answer this question in detail would require an exhaustive statistical study. In the absence of such a study we can answer the question in a general way: the “demand for crossings” probably obeys the law of demand, hence we show negatively sloped demand curves in FIG 2.17. Why are there two demand curves? $D_nD_n$ shows the demand for crossings during “normal” or regular hours (hence the subscript $n$) and $D_pD_p$ shows the demand during rush hour. (The subscript $p$ stands for “peak” or “peak-load demand.” The reason for this is explained below)

What about supply? Up to this point we have assumed that supply curves and demand curves have “normal” shapes embodying the laws of supply and demand. But here we come across a situation where a “normally” shaped supply curve would not make sense because of the limited physical capacity of the bridge. The Port Authority after all, could not respond to higher tolls by increasing bridge traffic! (At least this is true in the short run, where “short run” might mean several years) So the supply curve is shown as a vertical straight line. This says that, whatever the toll, the Port Authority is only able to supply so many crossings. (In Chapter 3 we call such a supply curve completely inelastic.) How do we know where to draw the vertical supply curve? Imagine that we ask the technical people who are in charge of the GWB, what is the hourly capacity of the bridge? They respond that 1,000 vehicles per hour can cross the bridge comfortably. So we draw the supply curve above the “1,000” point along the horizontal axis.

Now if the supply curve is $SS$ and during a normal hour the demand curve is $D_nD_n$, the “equilibrium toll” is $3$. (Note the arrow pointing to
“3” along the vertical axis.) Let’s assume that by luck or design the equilibrium toll is the actual toll charged at the GWB. Then during an average non-rush hour 1,000 vehicles can and do cross the GWB comfortably. Now rush hour arrives. People drive to work in the morning and drive home from work in the late afternoon. How do we show this graphically in FIG 2.17? We show it as a shift to the right of the demand curve (to \( D_pD_p \)), because in effect the demand for crossings increases during those times. What is the result? At the $3 toll the number of crossings demanded (1,400) exceeds the number supplied (i.e., the physical capacity of the bridge, or 1,000) and there is a “shortage” of crossings, which persons untutored in economics call a traffic jam!

If the market for crossings were a real (competitive) market the shortage referred to in the previous paragraph would lead to upward pressure on the price (i.e., the toll) and if the toll reached the new equilibrium level of $4 the “shortage” would be eliminated and traffic jams would disappear! But of course the GWB is not a real market, so the toll is kept for long periods at a fixed level ($3 in our example) and the toll does not play its market-clearing role. (NOTE: In Section 2.16 we discuss how equilibrium prices act as “market-clearing” prices.)

REM: The numbers used in all the preceding example are of course merely illustrative. No claim is made for example that raising the toll on the GWB during hours of peak-load demand from $3 to $4 will actually eliminate traffic jams!

PROBLEM 2.7: Can a graph like FIG 2.17 be used to analyze traffic congestion on a toll-free bridge or road? In other words, can supply-and demand analysis be used where there are no prices at all?

SOLUTION 2.7: Yes. Look at FIG 2.18 below. One can again ask, what is the physical capacity, say of Route 4 in Northern New Jersey? The experts punch up some numbers on their laptops and they come up with the answer: 2,200 vehicles per hour can cross some particular stretch of Route 4 easily. We then imagine how the number of crossings would be affected by different possible toll levels, even though we know the toll is zero! The result for a normal hour is shown by \( D_nD_n \) and for a “peak” hour by \( D_pD_p \) as before. During normal hours the supply curve and the demand curve “intersect” along the horizontal axis: the “equilibrium toll” is zero and the equilibrium number of crossings is 2,200. Now rush hour arrives: the demand for crossings increases and at a zero toll 3,000 vehicles try to cross this stretch of road in one hour. Again there
is a “shortage” (shown along the horizontal axis) and we say there is a “traffic jam” or there is “traffic congestion” on Route 4.

**QUESTION 2.19:** Do PROBLEMS 2.6 and 2.7 suggest any policy recommendations that may emerge from the application of supply-and-demand analysis?

**ANSWER 2.19:** Clearly (at least it’s clear to most economists!) the analysis of FIG 2.17 and FIG 2.18 suggest that the tolls on the GWB should be varied depending on the time of day (and perhaps that tolls should be imposed on all roads subject to congestion). During normal hours the current $3 toll should continue to be charged while during rush hours the toll should be raised to $4. Such a policy is called *peak load pricing* or *congestion pricing* and is discussed further in APPLICATION 3.1, which is taken from the *San Francisco Chronicle* of August 27, 2004.

**NOTE 2.37:** Peak load pricing policies are being adopted in a variety of settings throughout the world, often in the face of public opposition. In March 2001 the Port Authority of New York and New Jersey adopted what might be called a “mild” peak load pricing policy as shown in Table 2.5. (E-Z Pass is an electronic toll collection system.)
Table 2.5: Passenger Vehicle Toll Rates

<table>
<thead>
<tr>
<th></th>
<th>E-Z Pass Off-Peak Hours</th>
<th>E-Z Pass Peak Hours</th>
<th>Cash All Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autos</td>
<td>$7.50</td>
<td>$9.50</td>
<td>$12</td>
</tr>
<tr>
<td>Motor Cycles</td>
<td>$6.50</td>
<td>$8.50</td>
<td>$11</td>
</tr>
</tbody>
</table>

Source: www.panynj.gov/bridges-tunnels/tolls.html
APPLICATION 2.1:

**For whom the bridge tolls?**
Gregory L. Rosston
Friday, August 27, 2004

Gov. Arnold Schwarzenegger wants the Bay Area to pay for billions in cost overruns for the new eastern span of the Bay Bridge. State Sen. John Burton, D-San Francisco, reportedly has backed a toll increase to $4 for Bay Area bridges. This is on top of the $1 hike earlier this year. As a result, bridge tolls may double from last year.

But there is a much better way. As Paul Romer at the Stanford Graduate School of Business says, "A crisis is a terrible thing to waste." While these huge cost overruns and substantial toll increases are a big problem for drivers, there is an opportunity to use this crisis to improve transportation policy: Rather than simply imposing another price increase for all bridge travelers, we can adopt a system that would raise the same amount of money and reduce traffic, pollution and gas consumption at the same time.

Schwarzenegger has argued that the commuters in the Bay Area and our elected officials should bear the costs. In general, it is good economic policy to make sure that people pay for their actions. But this philosophy should not stop with a simple toll increase. People who commute at peak periods cause much larger costs than those who commute at other times. They cause "externalities" for all other drivers by worsening the huge rush-hour backups. These externalities increase commute times, increase gas consumption and spew exhaust fumes into our air. So, rush-hour commuters should either pay more or change their commute habits by taking mass transit, commuting at different times or telecommuting.

Providers of services such as movies, restaurants and phone usage make extensive use of peak-load pricing through matinees, early-bird specials and free nights and weekends. There is no reason that bridge commuters should not be given the same options.

FastTrak, the electronic toll-collecting technology, can smooth the implementation of higher rush-hour tolls. By the end of last year, about 30 percent of peak-hour traffic used FastTrak. FastTrak allows about three times more cars per hour through each toll booth than manual toll-takers. With variable pricing, commuters using FastTrak would not have to fumble through their wallets for a different amount of money according to the time of their crossing. In fact, a discount for FastTrak users might be reasonable, given the savings they provide in terms of less congestion and fewer toll-takers.

The peak price would not have to be too high. The Metropolitan Transportation Commission estimates that the $1 increase from earlier this year would translate into about $125 million per year. Instead of charging $4 all day long, a much better policy would be to charge $6 or more at rush hours. Because many drivers would opt to take public transportation, carpool or cross when the toll is cheaper, this would reduce traffic during the rush hour, when lots of excess gas is burned and exhaust fumes created. The peak-load toll increase would thus reduce congestion, increase fuel efficiency and reduce emissions. If 50 percent of the traffic crosses at peak hours (6-9 a.m. and 3-6 p.m.), then a $3 increase during those times would also probably produce about the same revenue as a flat $1 increase for all commuters.

This opportunity to create a more sensible pricing structure, to make people pay for the costs they cause and to improve the environment should not be wasted.

**Gregory L. Rosston is deputy director of the Stanford Institute for Economic Policy Research. He previously served as deputy chief economist of the Federal Communications Commission**

©2006 San Francisco Chronicle
2.16 Supply, Demand and the Allocation Problem

In Sections 2.0 we claimed that the resource allocation problem in a capitalist or market economy is solved at least in part by the forces of supply and demand or what we called “market forces.” In subsequent sections we concluded that in such an economy the quantities of goods and services produced and their prices are also determined by market forces. We now make the connection explicit. We assert that prices perform certain functions in a market economy and by performing these functions they (and therefore the markets in which they are determined) help solve the resource allocation problem. These are the clearing function, the signaling function, the incentive function and the rationing function. We discuss them in turn.

NOTE 2.38: In this section we explain how markets and prices help solve the allocation problem. In Chapter 7 we show that in a sense to be discussed later markets and prices solve the problem optimally (i.e., as efficiently as possible).

The Clearing Function of (Equilibrium) Prices

Equilibrium prices are sometimes called market-clearing prices. The reason is straightforward: in a market which is in equilibrium, i.e., when the equilibrium price prevails, there are neither surpluses nor shortages and we say that the market clears. This is a useful function because in a world of scarcity persistent surpluses and shortages are clearly wasteful. This is obvious in the case of surpluses: lasting surpluses (i.e., not just temporary surpluses resulting from a passing disequilibrium) entail the production of goods or services that no one wants. But shortages are also wasteful, since goods which people want (and are willing to pay for) are not being produced. So equilibrium prices established by so-called “market forces” play a useful role in the resource allocation process by preventing the emergence of wasteful surpluses or shortages.

The Signaling Function of Prices

What goods and services should be produced? Prices are said to provide signals to buyers and sellers in a market that give answers to this question. A rising price signals to buyers or users of a good that it has become “scarcer” and the need to economize on it has increased. Rising prices signal to producers or sellers of a good that there is an increased need, requirement, preference, in short demand for it; hence resources should be shifted towards producing more of this good. Falling prices of course send the opposite signal.

Another way to look at this question is to think of the market mechanism as a vast information transmission device: through prices, or more precisely through changing prices, information is transmitted to economic decision makers about changing
scarcities and changing preferences concerning goods and services. Such information is of course essential for “proper” decision making in the economy.

NOTE 2.39: There may be circumstances where market prices send false signals about “true” scarcities and preferences. We call such situations market failures, a topic we discuss in detail in Chapter 24.

The Incentive Function of Prices

Prices may provide signals or convey information but do producers, consumers and other economic decision-makers respond to these signals? The answer is yes, since in addition to providing information, prices, act as incentives. (REM DEF 2.14) Since rising (relative, or real) prices for particular goods and services are almost always accompanied by higher profits (at least in the short run) producers acting in their own self interest will respond by increasing production without any prompting or exhortation from political, religious or other public figures. Similarly, consumers or other users of particular goods and services, confronted by higher prices will respond by economizing on their use, switching to substitutes, etc., without sermons, public service announcements, etc., but simply out of self-interest.

It should be clear from the foregoing that the signaling and incentive functions of prices and markets are closely connected.

The Rationing Function of Prices

Since we live in a world of scarcity, every society must have some mechanism, set of arrangements or institutions for allocating (“rationing”) scarce goods among the people who want them. Markets and prices represent one such mechanism. The simplest way to approach this topic is by assuming that a good is available in fixed quantities that somehow must be allocated among some group of individuals who want it. How do markets and prices accomplish this task? Consider the supply of rental housing in Bayville in the state of Caltex again before rent control has been introduced. Assume we are viewing the problem from a short run perspective (say a few months to a year) and the supply is physically fixed. Who gets the apartments? The answer is simple: whoever is willing and able to pay the (equilibrium) rental price. Of course one implication of this is that if for some reason the equilibrium rental price does not prevail (for example because of rent controls) it cannot perform the rationing function and alternative mechanisms must be employed.

QUESTION 2.20: Assume that effective rent controls are imposed in some community and therefore the “equilibrium” rental cannot perform the rationing function. Describe four alternative rationing mechanisms.
ANSWER 2.20: If rent controls are effective, that is the controlled rental is *below* the equilibrium rental, there will be a *shortage* of available apartments. In other words, there are potential renters who are willing to pay the going price for an apartment but are unable to obtain one. They would therefore be willing to make a *side payment* (often called a “bribe”) to building managers, officials etc., to obtain an apartment in this community. So *bribery* is one alternative rationing device!

Describing three additional rationing mechanisms is left as an exercise for the reader.
Problems:

Use supply-and-demand analysis to answer the following questions. This means using supply-and-demand diagrams like the one below (or drawing your own graphs). Assume that supply-and-demand analysis is in fact applicable in all the relevant markets.

NOTE: Using the diagrams actively means using them to explain step-by-step how you arrive at your answer(s).

(1) Assume that because of a bad feed grain harvest, beef prices are expected to rise. What will (probably) happen to the equilibrium price and quantity of chicken? (Note: “feed grain” is fed to beef cattle.)

(2) Assume that medical research has revealed that eating large amounts of oatmeal reduces cholesterol levels. (Cholesterol is bad for you.) What will happen to the equilibrium price and quantity of oatmeal?

(3) People used to say that it was hard to find a taxi in New York City when it rained. Explain this phenomenon. (To say, when it rains, people don’t want to get wet, so more people want to take taxis, is not enough!)
(4) Copper is used mostly in electric machinery and for power transmission and telephony. Increasingly the last two of these tasks are being performed by aluminum and fiber optics. What will this (probably) do to the equilibrium price and quantity of copper?

(5) Assume a lumber mill can use its productive capacity and supplies of raw lumber to produce both construction lumber and wood pulp (used to produce newsprint on which newspapers are printed). If construction activity is expected to increase next year, what will (probably) happen to the equilibrium price and quantity of newsprint?

(6) What (probably) happened to the equilibrium prices and quantities of construction materials in Louisiana after hurricane Katrina hit?

(7) As a result of NAFTA American companies found it easier to relocate to Mexico. Mexico has a plentiful supply of unskilled labor. What (probably) happened to the equilibrium wages and employment of unskilled workers in the United States for this reason alone? (Note: NAFTA is the acronym for the North American Free Trade Association.)

(8) Assume the determinants of supply and demand for good X change in such a way that both the demand and supply increase. What will happen to the equilibrium price and quantity of good X? (Three things may happen to the equilibrium price; discuss all three.)

(9) Assume O.P.E.C. (the Organization of Petroleum-Exporting Countries) is again successful in raising the price of oil. What will happen to the equilibrium price and quantity of coal? (Coal and oil are substitutes in many uses.)

(10) The "Bladders", a currently popular rock group, are appearing in Madison Square Garden for a limited engagement. At all ticket outlets long lines of teenagers appear, and many leave disappointed, unable to obtain tickets. (In addition "scalpers" show up, selling tickets illegally.) Explain this situation using (of course!) supply-and-demand analysis.
(11) If the (relative) wages of coal miners were to rise, what would happen to the equilibrium price and quantity of coal?

(12) You visit Disney World and are seriously annoyed by the long waiting times at the most popular attractions. Use supply-and-demand analysis to devise a solution to this problem.

(13) Since 1949 the federal government has had a policy of price floors for milk and other dairy products. The current (2012) “milk support price” for whole milk is (approximately) $18.50 per hundred pounds, which is presumably below the equilibrium price. What do you think was (is) the result of this policy? Can the government simply announce that the price of raw milk is $x and leave it at that? Explain.